Chapter 5. Alternatives Analysis

5.1 Overview and Introduction

During the initial stages of the US Route 1 corridor study, a wide variety of potential corridor improvement concepts were identified. The preliminary concepts were developed to satisfy the goals of this project identified in the Project Function and Need document:

1. Support adopted local and regional plans by providing improvements to the US Route 1 corridor in the southern Prince William and northern Stafford Counties
2. Facilitate the movement of peak hour traffic flows to, from, and along US Route 1 in the study area, as well as assist in mitigating congestion due to incidents on I-95
3. Reduce peak hour traffic congestion and its effects on adjacent facilities, especially queuing at Marine Corps Base (MCB) Quantico's Main Gate on Fuller Road, by making improvements at key locations along US Route 1
4. Improve safety along US Route 1
5. Support regional transportation demand management initiatives
6. Support National Capital Region (NCR) evacuation plans, access to MCB Quantico for national security purposes, and access to major employment centers and areas for economic redevelopment

The preliminary concepts developed include different combinations of cross-sectional, intersection, corridor management and non-vehicular elements. To evaluate each concept based on their ability to satisfy the project goals, a preliminary, planning-level screening methodology was developed.

5.2 US Route 1

5.2.1 Preliminary Concepts

The preliminary concepts were developed using combinations of cross-sectional, intersection, corridor management, and non-vehicular elements. A matrix summarizing the proposed combinations of these options is presented in **Table 5-1**.

5.2.1.1 Cross-Sectional

Cross-sectional elements refers to the total number of lanes on US Route 1. The no build cross section is four-lanes undivided. The build concepts have four-, six-, or eight-lanes with a median.

5.2.1.2 Intersection

Intersection elements are the treatment of major intersections in the corridor. The options are to maintain at-grade intersections where they currently exist, implementing unconventional strategies at major intersections to eliminate conflicting traffic movements, or to grade separate at major intersections.

5.2.1.3 Management

Management elements attempt to make the best use of available capacity on US Route 1. One management element is to permit only high-occupancy vehicles (HOV) or transit vehicles on one lane in each direction. Two other management elements, access management and travel demand

management (TDM)/transportation system management (TSM), are included in every preliminary concept. Some examples of TDM/TSM include carpool/vanpool (rideshare) and employer shuttles. Since MCB Quantico is such a large employer in the study area, TDM/TSM initiatives for base personnel would have the greatest impact and should be explored further.

5.2.1.4 Non-Vehicular

Each preliminary concept includes non-vehicular elements such as a multi-use path and sidewalk along US Route 1 and intersection improvements, such as reconfiguring and/or adding lanes to one or more approaches.

Table 5-1: Preliminary Build Concepts – US Route 1

Route -1 Quantico Improvements Preliminary Concepts									
Element	Scenario								
	No Build	Base	1	2		3		4	5	6
				A	B	A	B			
Cross Section										
4 - Lane Undivided	●									
4 - Lane Divided								●		
6 - Lane Divided		●	●	●		●				
8 - Lane Divided									●	●
Intersections (Major)										
At Grade (grade separated at existing locations)	●	●	●						●	
Unconventional				●						●
Grade Separated						●		●		
Management										
HOV/Transit			●		●		●		●	●
Access Management		●	●	●		●		●	●	●
TDM/TSM		●	●	●		●		●	●	●
Non-Vehicular										
Multi-Use Path		●	●	●		●		●	●	●
Sidewalk		●	●	●		●		●	●	●
Intersection Modification		●	●	●		●		●	●	●

5.2.2 Screening Methodology

The preliminary concepts were screened using a set of evaluation criteria. The evaluation criteria are part of three overall categories: Operations, Impacts, and Cost, as shown in **Table 5-2**. Each concept is given a comparative score for every criterion up to a maximum of the weight shown at the top of each column. The score for categories is the sum of the scores for each criterion in that category. Weighting factors were applied to each category. The highest score that a concept can achieve is 100 points, the sum of the score for the three categories. The process for the comparative evaluation for each criterion is described below.

Table 5-2: Preliminary Screening Criteria and Weighting Factors – US Route 1

Category/Criteria	Weight	
Operations		
Link Capacity	20	
Intersection Capacity	20	
Transit/HOV Facilities	4	
SUBTOTAL:		**44**
Potential impacts		
Property/Right of Way	8	
Environmental	8	
Human & Physical Environment	8	
Access	8	
SUBTOTAL:		**32**
Construction Cost		**24**
TOTAL MAXIMUM SCORE		**100**

5.2.2.1 Operations – Link Capacity

The first traffic operations screening criterion for each concept is link capacity. The screening methodology used for this project is based on *Highway Capacity Manual* (HCM), *2000 Edition* capacity thresholds and the corresponding generalized level of service (LOS) tables developed by the Florida Department of Transportation (FDOT) for urban arterials, 2009 Edition. These tables provide maximum two-way peak hour link volumes for each HCM LOS category (LOS A to E) based on HCM methodology and general assumptions for percentage of heavy vehicles, directional split, lane width, and other input parameters.

For concepts with at-grade, signalized intersections, the table for Class I Arterial, defined in the HCM as an urban arterial with less than two signalized intersections per mile, was used. The Class I Arterial LOS Table is shown in **Table 5-3**.

Table 5-3: FDOT Class I Arterial LOS Table

STATE SIGNALIZED ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	930	1,500	1,600	***
4	Divided	2,840	3,440	3,560	***
6	Divided	4,370	5,200	5,360	***
8	Divided	5,900	6,970	7,160	***

Source: *Quality/Level of Service Handbook. Florida Department of Transportation, 2009*

For the grade-separated concepts, the table shown in **Table 5-4** for Uninterrupted Flow Highways was used:

Table 5-4: FDOT Uninterrupted Flow Highways LOS Table

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Median	B	C	D	E
2	Undivided	730	1,460	2,080	2,620
4	Divided	3,220	4,660	6,040	6,840
6	Divided	4,840	6,990	9,060	10,280

Source: *Quality/Level of Service Handbook. Florida Department of Transportation, 2009*

The maximum two-way capacity for each cross section (four, six, or eight lanes) was then divided in half to convert it to a one-way capacity. Using this value, projected volume- to-capacity (v/c) ratios were calculated for each link of US Route 1 within the study area for each potential cross section. These calculated v/c ratios were then divided into three categories:

1. Under capacity (v/c < 1.0) – 2 points
2. Over capacity (1.0 < v/c < 1.2) – 1 point
3. Severely over capacity (v/c > 1.2) – 0 points

Because this criterion was assigned a weighting factor of 20 in the overall evaluation, the total of all link scores for each cross-section was then converted to a relative scale from 0 to 20. The scenario with the highest score was assigned the maximum score of 20 points and all others were assigned a smaller value based on the relative difference between its link score and the highest scoring alternative. The resulting scores are shown in **Table 5-5**.

5.2.2.2 Operations

Intersection Capacity

Intersection capacity was analyzed using year 2040 projected traffic volumes at each signalized intersection along US Route 1 within the study area using Synchro 7.0 software. Each intersection was coded with the corresponding number of lanes on US Route 1 for each scenario. Additional turn lanes on each approach were added and the signal timing optimized to minimize vehicle delay. The delays reported by Synchro for all study intersections were averaged by alternative to obtain a single delay value to be used in the evaluation process. Since this criterion was also assigned a weighting factor of 20 in the overall evaluation, the vehicle delay results for each concept were again converted to a 0 to 20 scale. The alternative with the minimum average delay value was assigned the maximum of 20 points while all other concepts were assigned a smaller value based on the relative difference between its average delay value and the highest scoring alternative. The resulting scores are shown in **Table 5-5**.

All concepts that included grade separations at major intersections were also assigned a maximum value of 20 points since there would be no delay for US Route 1 traffic at those intersections. For the concepts with unconventional intersections, it was assumed that eliminating the left-turn movements off US Route 1 by constructing either jug-handle loops or Michigan-style lefts (right-turn movement followed by a signalized U-turn movement at a mid-block location) were the most likely concepts. Roundabouts will likely be infeasible due to the high traffic volumes and number of approach lanes

at the major intersections. It is not possible to model the exact operation of unconventional intersections using Synchro software. However, in both the jug-handle loops or the Michigan-style lefts treatments, the left-turn movements on the major street are eliminated and replaced with either a right-side loop just after the intersection, or by turning right onto the side street and making a U-turn. In each case, this traffic then passes through the intersection again as part of the side-street through movement. To create a close approximation of in Synchro, the left-turn phases were removed and the left-turn volumes were added to the right-turn movements on that approach and also to the side-street through movement. The signal timing was then re-optimized with the revised phasing and volumes. If an alternative that includes unconventional intersections is carried forward for more detailed analysis, the VISSIM microsimulation model will be used to model a more accurate representation of the operation of these intersection treatments.

Transit/HOV Facilities

Some concepts provide an exclusive travel lane along US Route 1 that would only be available to transit and other high-occupancy (HOV) vehicles. These concepts were assigned 4 points. The scores are shown in **Table 5-5**.

5.2.2.3 Potential Impacts

Property/Right-of-Way

Potential property impacts were evaluated comparatively based on the extent of impacts. Interchanges and widening will have the greatest potential impact to property due to the greater area of impact. The no build concept received the maximum score of 8 points, while all other concepts received a score based on the relative difference between its estimated area of right-of-way impact and the highest impact concept. The scores are shown in **Table 5-5**.

Access

The intersection improvement alternatives have varying impacts to access to the adjacent businesses. Alternatives that included a six-lane cross section and standard at-grade intersections scored the highest in this category (8 points) because it was assumed that most driveway access could remain unchanged. As additional treatments were added, the score was lower. For example, widening to eight lanes lowered the score because more driveways would need to be closed or consolidated. Unconventional intersection treatments (jug handles, etc.) would also require additional driveway modifications and lowered the Access category score. The greatest impact to access was due to grade-separated intersection. Those alternatives that included grade-separated intersections scored the lowest in this category (0 points). The scores are shown in **Table 5-5**.

Natural Environment

Potential natural environment impacts were evaluated comparatively based on the number and/or areal extent of impacts as well as the relative ecological value of the resources. For example, an encroachment into a large wetland/stream system was considered a more significant impact than an encroachment into a small tributary or isolated wetland. The concepts were given a score of 1 through 3 for the following sub-criteria:

- Number of stream crossings
- Number of natural resource encroachments
- Assessment of impact area and resource value
- Extent of natural resource encroachment
- Assessment of potential habitat, encroachment into MCB Protected Natural Area

The sub-criteria scores were summed for each concept. Because this criterion was assigned a weighting factor of 8 in the overall evaluation, the total impact scores was then converted to a relative scale from 0 to 8. The concepts with the least comparative potential natural environment impacts have the highest scores. The scores are shown in **Table 5-5**.

Human and Physical Environment

Potential human and physical environment impacts were evaluated comparatively based on the number and/or areal extent of impacts. Interchanges and jug-handle intersections will generally have the greatest potential impact to farmland, historic resources, potential hazardous materials, noise-sensitive areas, and low-income or minority populations due to the greater area of impact and the proximity of the proposed improvements to these resources. The concepts were given a score of 1 through 3 for the following sub-criteria:

- Area of impact
- Proximity/number of sensitive noise receptors
- Number/extent of archaeological/architectural resource impacts
- Assessment of disproportionate noise/visual impacts to environmental justice populations
- Evaluation of land uses that may represent Recognized Environmental Conditions (RECs)

The sub-criteria scores were summed for each concept. Because this criterion was assigned a weighting factor of 8 in the overall evaluation, the total impact scores was then converted to a relative scale from 0 to 8. The concepts with the least comparative potential natural environment impacts have the highest scores. The scores are shown in **Table 5-5**.

5.2.2.4 Construction Cost

Preliminary opinions of probable cost were prepared for each concept. The opinions of probable cost were developed Virginia Department of Transportation (VDOT) 2009 Statewide Planning Level Cost Estimates. The Base concept received the maximum score of 24 points, while all other concepts received a score based on the relative difference between its estimated construction cost and the highest cost concept. The preliminary opinions of probable cost and score for each concept are shown in **Table 5-5.**

5.2.3 Screening Results

The highest ranked concept based on this screening process was Alternative 4, which included maintaining the current four-lane cross section between intersections, but constructing bridges over all signalized intersections so that through traffic on US Route 1 could bypass the signal uninterrupted. However, grade separating all major intersections on US Route 1 was not supported by the stakeholders due to sight obstruction and property access concerns. It was agreed that the two build concepts to be carried forward for further analysis were the six- and eight-lane concepts. Furthermore, based on the traffic analysis performed during this screening process it was determined that future traffic volumes north of Russell Road did not justify an eight-lane cross section. The final US Route 1 build concepts recommended for further study were:

- **Build Scenario 1**: Six-lane cross section throughout (Joplin Road/Fuller Road to Telegraph Road)
- **Build Scenario 2**: Combination of six-lane and eight-lane cross sections
    - Six-lanes north of Russell Road interchange (Joplin Road/Fuller Road to Russell Road)
    - Eight-lanes south of Russell Road (Russell Road to Telegraph Road)

All design year traffic projections used for the screening of these alternatives assume that the forecasted traffic is able to reach the study area and is not metered by bottlenecks outside the study area. This study assumes that US Route 1 north and south of the study area will be widened to six lanes and the that I-95 interchanges at Russell Road and Joplin Road will be improved to handle 2040 traffic volumes.

5.3 US Route 1/Russell Road Interchange

5.3.1 Preliminary Concepts

One of the obstacles to traffic flow in the study area is the unusual configuration of the US Route 1 and Russell Road interchange. The through movements on both roadways are grade-separated and pass through with little or no delay. However, all turning movements must use the ramps on the southwest and northeast quadrants of the interchange and make turns onto the other roadway at unsignalized intersections. During peak hours, traffic at these unsignalized intersection experience excessive levels of delay, especially at the intersection east of US Route 1.

Six preliminary build concepts were developed for the US Route 1/Russell Road interchange. They incorporated previous concepts provided by MCB Quantico staff and ranged from signalizing the two intersections on Russell Road to a complete reconstruction of the interchange as a fully directional cloverleaf layout. A comparison of all preliminary build concepts is presented in **Table 5-6**. **Figure 5-1** and **Figure 5-2** show the specified laneage, traffic control, and signalized intersection capacity.

Concept A

This concept adds a ramp for the northbound traffic on US Route 1 to continue eastbound on Russell Road. The new ramp allows the AM traffic to travel into MCB Quantico while eliminating a left turn from the US Route 1 Ramp onto Russell Road that currently requires a representative from MCB Quantico to direct traffic during peak hours. Concept A also widens Russell Road to six lanes (three eastbound and three westbound) and one auxiliary westbound lane across US Route 1 to I-95. The existing centerline of Russell Road would be shifted to the east to avoid impacts to the Locust Shade Park. This concept has two signalized intersections on Russell Road, one on either side of US Route 1.

Concept B

Concept B was developed by modifying Concept A to improve operations on Russell Road. In Concept B, the signalized intersections are located along US Route 1 to the north and south of the Russell Road overpass. This concept eliminates all left turns on Russell Road while increasing the interchange's capacity, but adds left-turn movements at new intersections on US Route 1. In addition, the existing centerline of Russell Road was shifted to the east to avoid any potential impacts to the Locust Shade Park, which is located on the northwest quadrant of the interchange.

This concept was discussed at stakeholder meetings, which included representatives from the different stakeholders. At these meetings, VDOT expressed concerns with the introduction of signalized intersections on US Route 1 at this location.

Table 5-5: Preliminary Screening Matrix – US Route 1

	Prioritization Factors											
	2040 Operational MOE				Impacts					Cost		
	Link Capacity	Intersection Capacity*	Transit/HOV lane Facilities	Total Operations Score	Property/ROW	Access	Environmental	Human & Physical Environment	Total Impacts Score	Cost Score	Prioritization Score	Overall Ranking
Maximum # of Points	20	20	4	44	8	8	8	8	32	24	100.0	
Alternative 4												
4 lane cross-section - Grade separated	16.0	20.0	0	36.0	8.0	0.0	3.3	5.1	16.4	15.7	**68.1**	**1**
Base												
Programmed improvements including widening to 6 lanes	6.7	6.8	0	13.4	3.7	8.0	8.0	8.0	27.7	24.0	**65.1**	**2**
Alternative 5												
8 lane cross-section - Transit/HOV lane	16.0	10.5	4	30.5	0.9	5.3	6.0	5.1	17.3	17.2	**65.1**	**3**
Alternative 6												
8 lane cross-section - Transit/HOV lane - Unconventional intersections	16.0	10.6	4	30.6	0.0	2.7	4.7	5.1	12.4	15.9	**58.9**	**4**
Alternative 1												
6 lane cross-section - Transit/HOV lane	0.0	0.4	4	4.4	3.7	8.0	8.0	8.0	27.7	23.9	**55.9**	**5**
Altenative 2A												
6 lane cross-section - Unconventional intersections	6.7	6.2	0	12.8	2.7	5.3	6.0	5.8	19.9	22.1	**54.9**	**6**
Alternative 3B												
6 lane cross-section - Transit/HOV lane - Grade separated	20.0	20.0	4	44.0	1.8	0.0	3.3	5.1	10.3	0.0	**54.3**	**7**
Alternative 3A												
6 lane cross-section - Grade separated	20.0	20.0	0	40.0	1.8	0.0	3.3	5.1	10.3	0.3	**50.5**	**8**
Alternative 2B												
6 lane cross-section - Transit/HOV lane - Unconventional intersections	0.0	0.0	4	4.0	2.7	5.3	6.0	5.8	19.9	22.0	**45.9**	**9**

Notes:

* For the purpose of this evaluation, grade separated intersections were assumed to have no delay and assigned the maximum points.

Concept C

This partial cloverleaf design eliminates one of the signals along US Route 1 in Concept B. This concept also includes a "Florida T-intersection" that allows the US Route 1 northbound traffic to pass through the signalized intersection without the need to stop. US Route 1 southbound traffic stops for the left turns from the on ramp from eastbound Russell Road to northbound US Route 1. The existing centerline of Russell Road was shifted to the east and Russell Road was relocated to the south to avoid any impacts to the Locust Shade Park.

Concept D

Concept D is similar to Concept C with the exception of the "Florida T-intersection". The signalized intersection requires both the northbound and southbound thru traffic on US Route 1 to stop for the left turn movement from the on-ramp from eastbound Russell Road to northbound US Route 1 (Ramp E). Also, the off-ramp from northbound US Route 1 tapers off US Route 1 further south than Concept C to avoid the northbound queues at the signalized intersection. The existing centerline of Russell Road was shifted to the east and Russell Road is relocated to the south to avoid any impacts to the Locust Shade Park.

Concept E

This concept introduces the use of a full cloverleaf interchange, which allows connections for all movements without the need for signalized intersections or creating conflicting left movements. The existing centerline of Russell Road was held in its existing position in this concept to minimize stream crossings and wetland impacts. However, there are impacts on the Locust Shade Parks due to the on-ramp from westbound Russell Road to southbound US Route 1 (Ramp C) and the off-ramp from SB US Route 1 to westbound Russell Road (Ramp D). Concepts C and D depict how the alignment shifts to prevent impacts to Locust Shade Park impact the existing streams and wetlands.

Concept F

This concept introduces the use of a trumpet interchange that provides a connection between US Route 1 and the I-95 ramps, thus reducing the amount of traffic on Russell Road. Besides the standard "Trumpet" layout, this concept combines two other connection techniques to achieve an appropriate traffic operation level:

It includes a "direct connect" flyover from eastbound Russell Road to northbound I-95

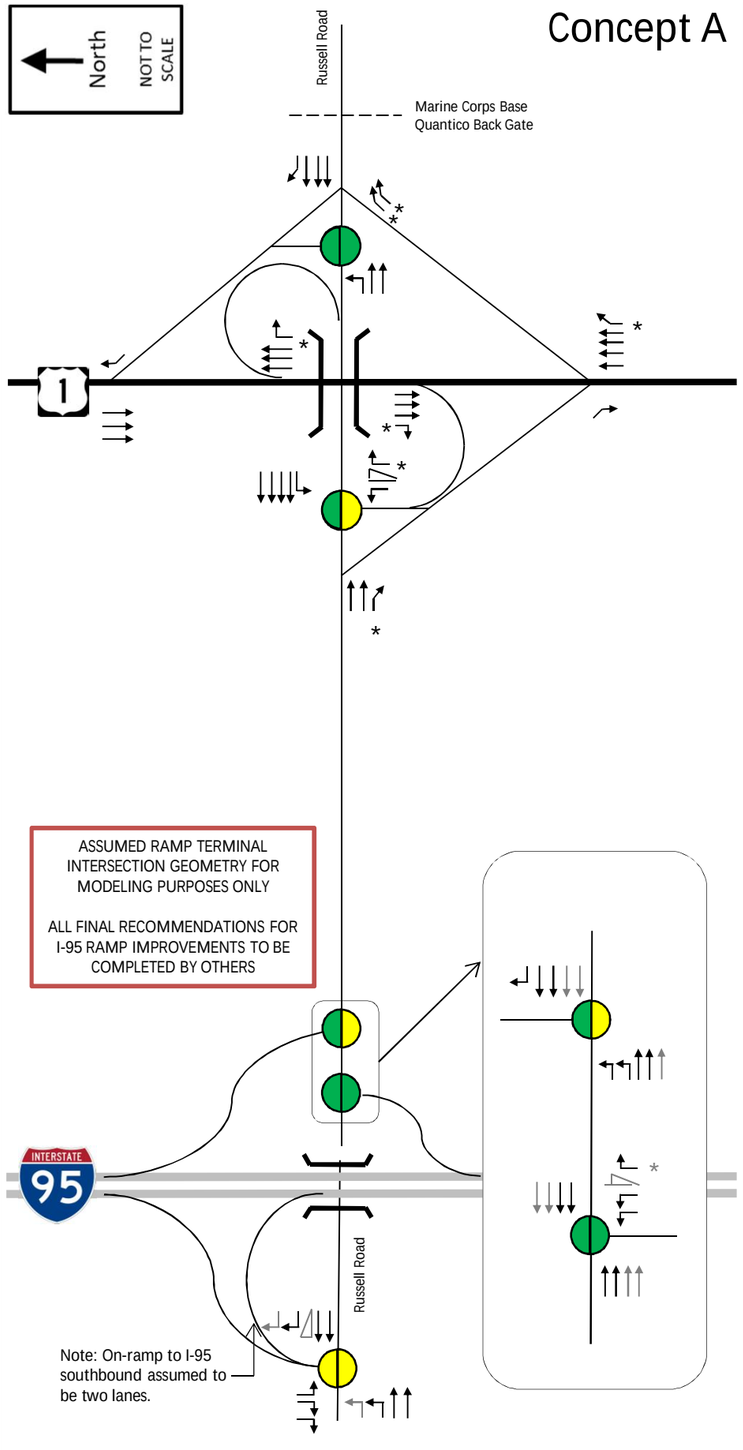
- It includes a quadrant of a "Cloverleaf" interchange to provide the on-ramp from westbound Russell Road to southbound US Route 1and the off-ramp from southbound US Route 1 to westbound Russell Road

Table 5-6: US Route 1 and Russell Road Concepts

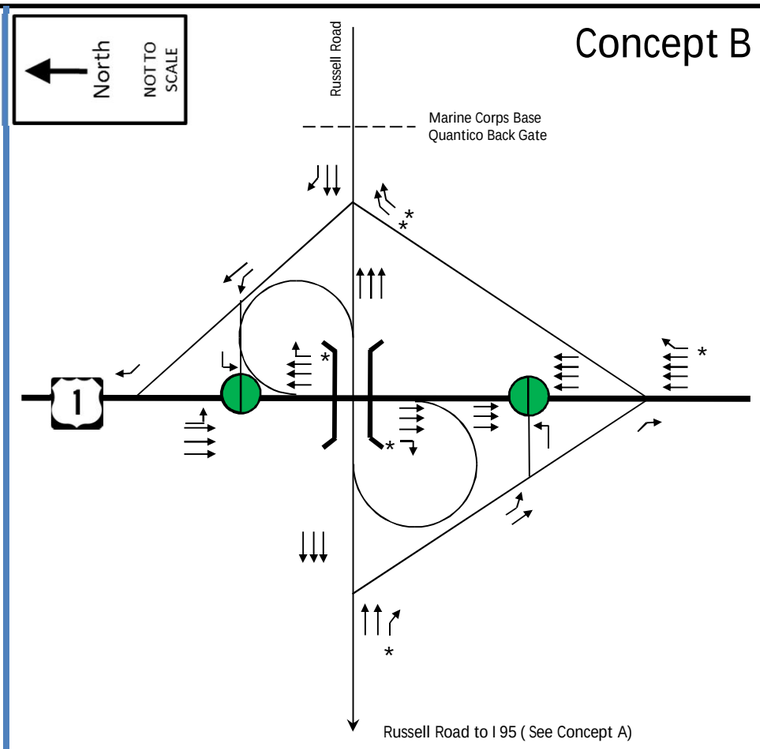
Concept	# of Signalized Intersections	Signalized Intersection Location	Direct Access Ramp to Back Gate from US Route 1 northbound	Eastbound Russell Road lanes across US Route 1	Westbound Russell Road lanes across US Route 1	Additional Notes
No-Build	2	Russell Road and US Route 1 Ramp Termini	No	2	2	Original recommendation based on Russell Road Traffic Operational Report[5]
A	2	Russell Road and US Route 1 Ramp Termini	Yes	3	3 plus auxiliary	Modification of original recommendation based on Russell Road Traffic Operational Report
B	2	US Route 1 and Russell Road Ramp Termini	Yes	3	3	Signals located north and south of Russell Road
C	1	US Route 1 southbound and Russell Road eastbound terminus	Yes	3	3	Realigned Russell Road Northbound US Route 1 traffic not included in signal
D	1	US Route 1 and Russell Road eastbound terminus	Yes	3	3	Realigned Russell Road Ramp to Back Gate Diverges prior to signal
E	0	N/A	Yes	2 plus auxiliary	3 plus auxiliary	Based on concept provided by MCB Quantico
F	1	Russell Road and I-95/US Route 1 Connector	Yes	3	3 plus auxiliary	Provides direct connection from I-95 northbound and Route 1 Based on concept provided by MCB Quantico

[5] Russell Road Traffic Operational Report, Parsons Transportation Group, 2011

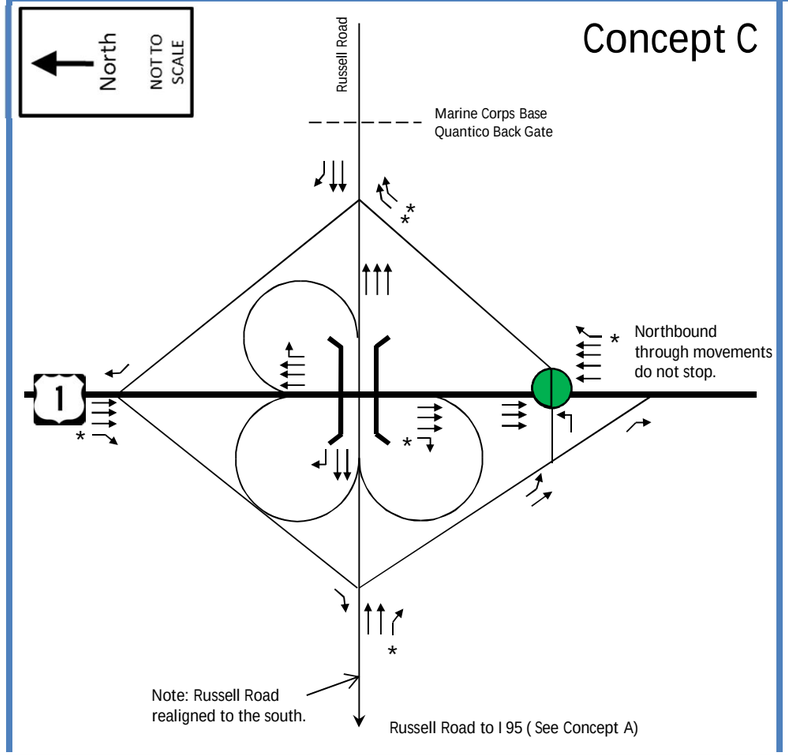
Concept A



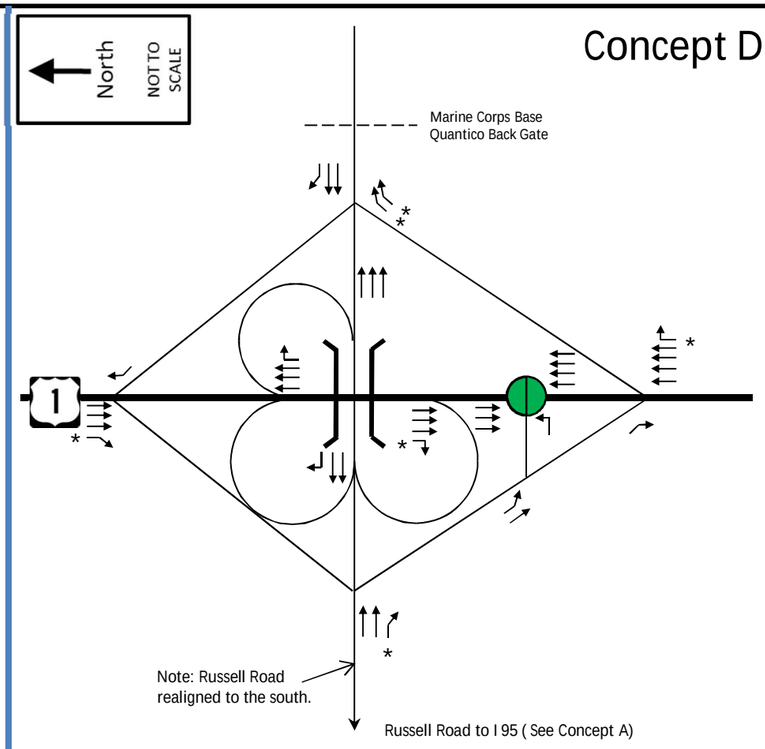
Concept B



Concept C



Concept D



Note: Assumed lane configuration represents conditions necessary for interchanges with I-95 to function at a LOS of D or better.

LEGEND

- Lane Configuration (* Denotes Free Right Turn)
- Median Island
- Assumed improvement (See Note)
- AM|PM Overall Signalized Intersection Level of Service
  - LOS A or B
  - LOS C or D
  - LOS E or F

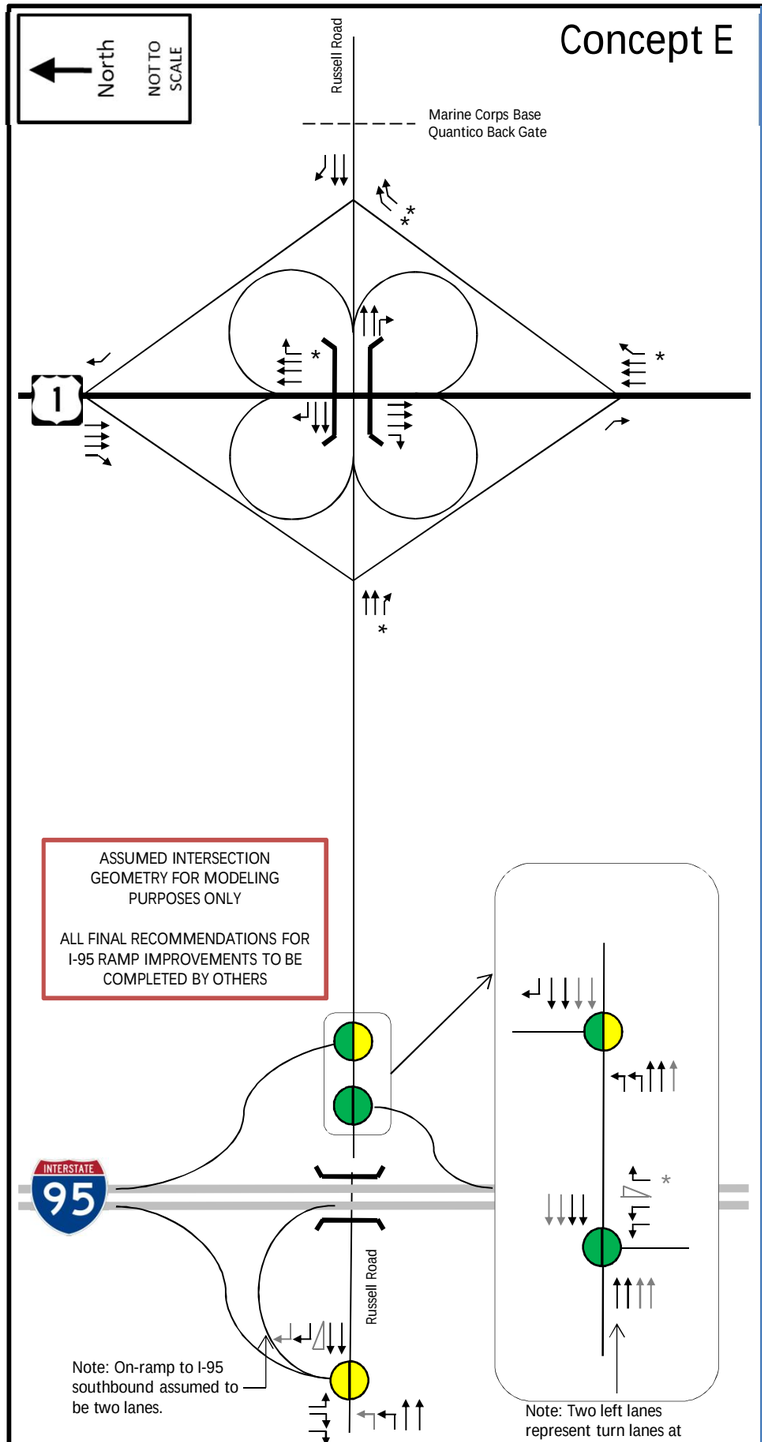
2040 US 1/Russell Road Build Concepts (A-D)
Lane Configuration and Intersection Capacity

US Route 1 Corridor at Marine Corps Base Quantico
Planning/Preliminary Engineering Study
Federal Highway Administration
Eastern Federal Lands Highway Division

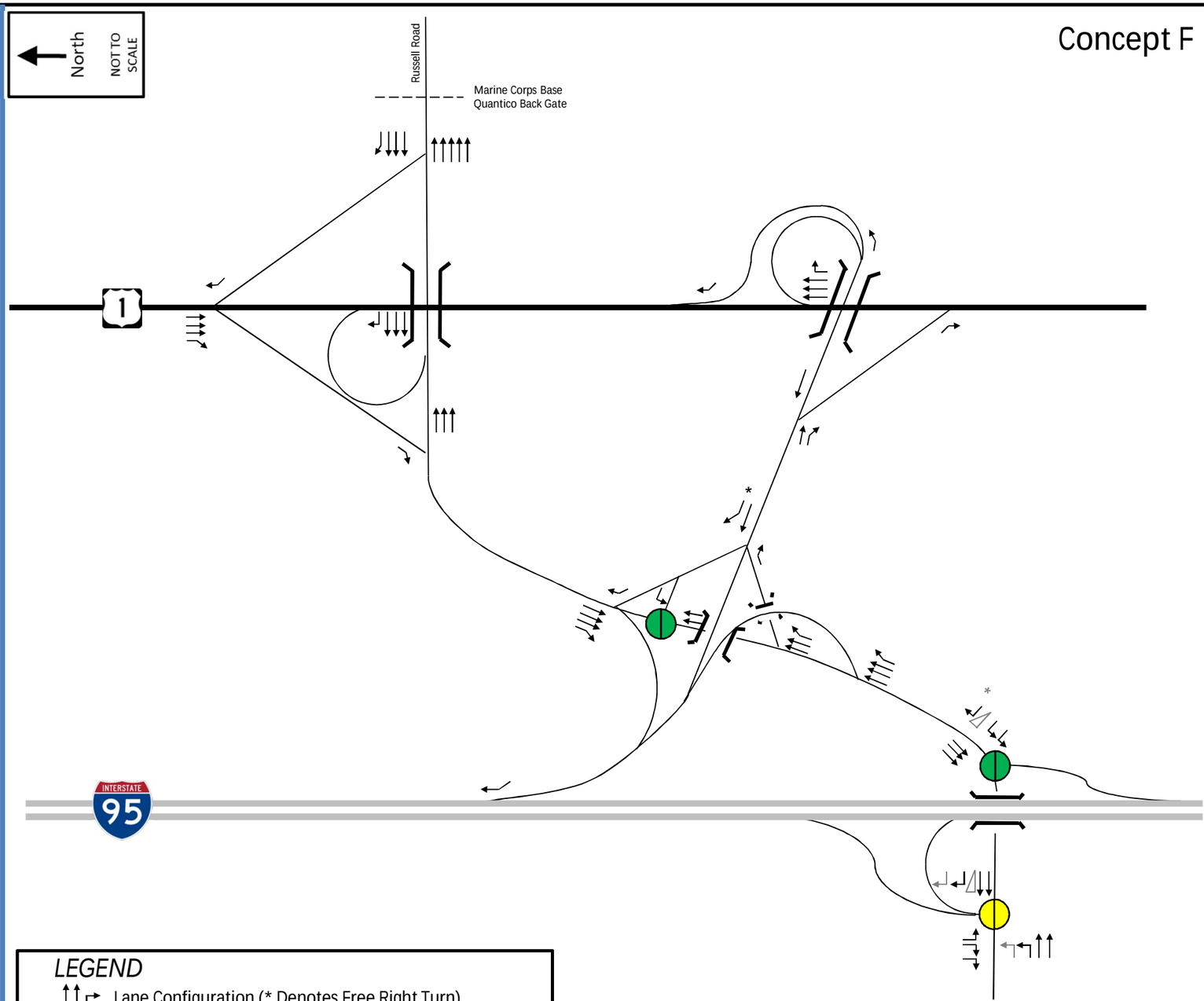
Kimley-Horn and Associates, Inc.

FIGURE
5-1

Concept E



Concept F



LEGEND

- Lane Configuration (* Denotes Free Right Turn)
- Median Island
- Assumed improvement (See Note)
- AM|PM Overall Signalized Intersection Level of Service
  - LOS A or B
  - LOS C or D
  - LOS E or F

Note: Assumed lane configuration represents conditions necessary for interchanges with I-95 to function at a LOS of D or better.

2040 US 1/Russell Road Build Concepts (E-F)
Lane Configuration and Intersection Capacity

US Route 1 Corridor at Marine Corps Base Quantico
Planning/Preliminary Engineering Study
Federal Highway Administration
Eastern Federal Lands Highway Division

Kimley-Horn and Associates, Inc.

FIGURE
5-2

5.3.2 Screening Methodology

The preliminary concepts for the US Route 1 at Russell Road interchange were evaluated based on similar screening criteria as the US Route 1 cross section alternatives described in Section 4.3. Each alternative was scored in three categories: traffic operations, potential environmental impacts, and construction/right of way cost. The alternatives were assigned a score in each category. The alternative that best satisfied that criterion was given a maximum score of 5, while the lowest ranking alternative was assigned a score of 0 in that category. The scores from each category were totaled for a final score for each alternative. The results of this methodology are presented in **Table 5-7**.

Traffic Operations

The no-build scenario traffic analysis revealed that no-build alternative would result in extreme vehicle delays and queuing by the design year 2040. As a result, it was removed from consideration as a viable alternative. Alternatives A and B scored the lowest of the build alternatives because of the delays at the signalized intersections, but overall delays and levels of service were still shown to operate at an acceptable LOS C or better in both peak hours. The remaining concepts eliminate one or both of the signalized intersections at the interchange and have lower overall delay results. Traffic analysis results from Synchro for Alternatives C, D, and F show minimal vehicle delay for these concepts. The best overall design for the interchange from a traffic operations perspective was Alternative E – the full cloverleaf option. Since all movements are free flow, it results in virtually no vehicle delay.

Construction/Right-of-Way Acquisition Costs

Concepts A and B would have the lowest overall cost because they closely maintain the existing footprint of the interchange. Alternative E would have the next lowest cost, followed by Alternatives C and D. Alternative F had the highest cost of construction and right of way acquisition because it includes an entirely new connection from US Route 1 to the I-95/Russell Road interchange.

Potential Environmental Impacts

The environmental impact scores were very similar to the construction/right-of-way acquisition scores. Alternatives A and B stay mostly within the existing footprint and limit potential impacts to the surrounding environment and have the highest scores in this category. Alternative E has the next highest score, but potentially impacts Locust Shade Park in the northwest quadrant. Alternatives C and D require a relocation of Russell Road to avoid Locust Shade Park, but require new stream crossings. Finally, the new roadway connection included in Alternative F has the greatest impact to the surrounding environment.

5.3.3 Screening Results

As shown below in **Table 5-7**, the highest ranking alternatives based on these criteria were Alternative A, due to its relatively low construction/right-of-way and potential environmental impacts, and Alternative E, mainly because it performs so well in the traffic operations category.

Based on these results, a new hybrid concept was developed that combines the best features of both Alterative A and E. The resulting Build Alternative G takes the roadway configuration from Alternative A west of US Route 1 to minimize potential impacts to Locust Shade Park in the northwest quadrant of the interchange, and the roadway configuration from Alternative E east of US Route 1 to eliminate the signalized intersection in close proximity to the MCB Quantico Back Gate. All three alternatives were carried forward for further analysis and input from the stakeholders and public.

Table 5-7: Preliminary Screening Matrix – US Route 1/Russell Road Interchange

Category			Concept*							Notes
			No-Build	A	B	C	D	E	F	
Operations	Intersection Capacity	Score		0	0	4	4	5	3	• All signalized intersections in all build concepts operate at LOS C or below in both peak periods • Concept E scored the highest due to having no signalized intersections
Cost	Construction Cost	Score		5	4	2	2	3	0	• The low construction cost score for Concepts C and D were primarily due to the relocation of Russell Road • Concept F has a low construction cost and right-of-way cost score due to its complex configuration and construction of a new connector road between US Route 1 and I-95
	Right-of-Way Cost	Score		5	4	2	2	3	0	
	Average	Score		5	4	2	2	3	0	
Impact	Environmental Impact	Score		5	4	1	1	3	0	• Concepts A and B most closely represent existing environmental footprint and limit amount of new stream and wetland impacts • Concepts C, D, and F involve multiple new stream crossings for bridges and roadways • Concepts E and F impact Locust Shade Park in the northwest quadrant of the interchange
TOTAL	Cost/Benefit/Impact	Score		10	8	7	7	11	3	• The no-build concept was not scored or ranked because it does not meet the project function and need statement
		Rank		2	3	4	4	1	6	

*Concepts
Concept A: Modified version of existing configuration, adding northbound to eastbound ramp
Concept B: Two signals relocated to US Route 1
Concept C: Realigned Russell Road, partial cloverleaf (One signal on US Route 1)
Concept D: Modified Concept C with alternative ramp location
Concept E: Full cloverleaf
Concept F: US Route 1/I-95N connector

5.4 Conclusions

This chapter summarizes the preliminary analysis portion of the project. The preliminary build concepts for US Route 1 were developed incorporating different options for typical cross-section, general intersection configuration, transit/TDM/TSM accommodation, and non-vehicular accommodation. These concepts were analyzed and ranked comparatively based on three main categories which were developed from the project objectives:

- Traffic Operations
- Potential Environmental Impacts
- Construction Cost/Benefit/Impact

Based on the results from this screening and discussions with stakeholders, two refined alternatives were carried forward in the project process for more detailed analysis.

- **Build Scenario 1**: Six-lane cross section throughout (Joplin Road/Fuller Road to Telegraph Road)
- **Build Scenario 2**: Combination of six-lane and eight-lane cross sections
    - Six-lanes north of Russell Road interchange (Joplin Road/Fuller Road to Russell Road)
    - Eight-lanes south of Russell Road (Russell Road to Telegraph Road)

Alternatives for the US Route 1/Russell Road interchange were developed and analyzed to ensure efficient traffic operations, minimize environmental impacts and increase value of construction cost. The two alternatives (A & E) that scored the highest in this screening were merged into a third design (G) and the three were carried forward for further analysis.